

# PATENT SPECIFICATION

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COMPLETE SPECIFICATION

DRAWINGS ATTACHED

280  
166

## Improvements in or relating to Folding Steps

We, FORD MOTOR COMPANY LIMITED, of 88, Regent Street, London, W.1., a Company incorporated under the laws of Great Britain, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to motor vehicles and more particularly to an auxiliary step for motor vehicles.

The bodies of omnibuses, trucks and similar motor vehicles are frequently so constructed that their floor levels are a considerable distance above the ground. It is, therefore, desirable and often necessary that a step be provided to facilitate ingress and egress to and from the vehicle. In its simplest form the step may comprise a rigid structure located interiorly or exteriorly of the vehicle body adjacent the door opening. If located interiorly the step requires an undesirable and frequently dangerous depression or stair well on the vehicle floor. If located exteriorly, the step supporting structure presents an undesirable appendage which increases the external dimensions of the vehicle. It has been recognized that a movable or, preferably, a foldable step structure is required to overcome the objections to the rigid or integral step structure.

The invention provides an improved foldable step structure which is automatically positioned to facilitate entry and exit when the vehicle door is opened. The step is also automatically positioned out of the way beneath the floor of the vehicle body when the door is closed.

The moving parts may be so constructed and arranged as to reduce the possibility of high friction in the system which might result from corrosion of the parts.

It is preferred to provide an actuating mechanism which will not "feed back" the loads imposed upon the step in its operative position to the vehicle door.

The above results are obtained in a preferred embodiment by supporting the step from the underside of the vehicle floor board in such a manner that it may swing from the operative position, upwardly and inwardly to a storage position under the floor board. The movement of the step is controlled by a lever system which is connected to be actuated by the opening and closing of the vehicle door.

The invention will be further described with reference to the accompanying drawings, wherein:

Figure 1 is a perspective view of a portion of a vehicle body incorporating this invention with parts broken away for clarity of representation;

Figure 2 is a section showing the step in its retracted position; and,

Figure 3 is a similar section showing the step in its operative position.

Referring now in detail to the drawings, there is shown generally at 10 a vehicle body comprising a floor board 11 and a side panel structure 12 to which a door 13 is conventionally hinged for swinging movement between open and closed positions. Suspended beneath the floor board 11 in contiguous relation to the door opening is a foldable step assembly, generally designated 14. The step assembly 14 comprises a tread panel or step 15 hinged at its rear edge by ordinary strap hinges 16 to a riser 17, pivotally suspended at its upper edge from pivot pins 18 rotatably journaled in suitable brackets 19 secured to the underside of the vehicle floor board 11. The riser 17 forms one support link of a linkage supporting the tread panel or step 15 for bodily shiftable movement from an inoperative position beneath the vehicle floor board 11 to an operative position, as will be more fully

explained. In addition to the riser 17, additional support links 20 are positioned outwardly of the riser to support the tread panel or step 15. These links 20 are located one at each side of the step and are pivotally suspended from pivot pins 22 carried beneath the floorboard 11. The links are pivotally connected at their lower ends to the tread panel or step by pivot pins 21.

The mechanism for actuating the step assembly is located at the side of the step assembly nearest the hinge axis of the door and consists of a rod 23 secured at one end thereof to the door 13 by means of grommet 24 held in bracket 25 which is, in turn, suitably secured to door 13. The other end of the rod 23 is bent and coacts with a slot 26 formed in one arm 27 of a bell crank 28. Rod 23 is maintained in slot 26 by means of washer 29 and split pin 30. The arm 27 of bell crank 28 extends through a slot 31 formed in the floor board 11. Bell crank 28 is mounted below the floor board for pivotal movement about pin 18. The other arm 32 of bell crank 28 is pivotally connected at its end to one end of a link 33 by a pin 34. At its other end link 33 is pivotally connected to link 20 intermediate the ends thereof as by pin 35. A tension spring 36 is connected between pin 34 and a pin 37 suitably secured to one of the brackets 19.

In operation, as the door is opened from the closed position shown in figure 2 the bent end of rod 23 traverses slot 26 in arm 27 of bell crank 28. After the end of the rod has been brought into abutment with the end of slot 26, bell crank 28 is pivoted in a clockwise direction about pin 18. It should be noted that grommet 24 allows sufficient relative motion between the rod 23 and the door during this action. As bell crank 28 pivots, motion is transmitted to link 33 causing it to pivot at each of its ends and, in turn, cause link 20 to pivot about pin 22 in a counter-clockwise direction. The action of link 20 upon step or tread panel 15 causes the step assembly to swing into the operative position, shown in Figure 3. Riser 17 causes the step to assume a position which is substantially parallel to the floor board 11 and serves to hold the step level as loads are applied to the step.

It is to be noted that the arm 32 and the link 33 together form a toggle which goes over centre just before the door reaches fully open position. This reverses the action of the spring 36 on the bell crank 28 so that when this position is reached the bell crank is urged clockwise, as seen in figures 2 and 3, until it abuts the right hand end of the slot 31. In this position it acts as a limit stop for the movement of the step and of the door, and loads on the step are not transmitted to the door but are absorbed into the floor panel.

When the door is closed, rod 23 again traverses slot 26 and causes the step assembly 14 to move into the storage position in a manner reverse to that above described. The spring 36 acts to assist in the closing movement and thus no extra force is required to close the door.

As has been noted, rod 23 must traverse slot 26 before the step is actuated. This "lost motion" prevents any load on the tread panel when in its operative position from feeding back into the door mechanism. This slot is also located above the floor board in the vehicle interior so that it will not be exposed to the elements. In this way the slot will not rust and this part of the device will continue to operate trouble-free for a period of years.

It will be understood that the invention is not to be limited to the exact construction shown and described but that various changes and modifications may be made without departing from the scope of the invention, as defined in the appended claims.

#### WHAT WE CLAIM IS:—

1. A motor vehicle body construction, comprising a movable step, means supporting said step for movement from an operative position to a storage position and means operatively connectable to a vehicle door to control movement of said movable step between its operative and its storage position in response to movement of the vehicle door, in which the control means comprises a lever system constructed and arranged to isolate loads imposed upon said step in its operative position from said door.

2. A body construction as claimed in claim 1, in which the step is supported for swinging movement from the operative position, upward and inward to the storage position under the vehicle floor.

3. A body construction as claimed in claim 1 or 2, in which the lever system includes a toggle connection arranged to go over centre as the door approaches a fully open position, to isolate loads on the step from the door.

4. A body construction as or claimed in claim 3, in which the lever system is brought to rest by an abutment in a position just beyond the over centre position of the toggle.

5. A body construction as claimed in claim 4, in which the abutment is formed by one end of a slot in a panel forming part of the vehicle floor.

6. A body constructed as claimed in any of claims 3 to 5, comprising linkage means operatively connected to said step and to the body allowing swinging movement to said step between operative and storage positions, a first link pivoted at one end to said step and at the other end to the body, a bell crank pivotally connected to the body and having an extending arm, a second link pivotally

connecting said arm and said first link and forming the said toggle with said arm, and an actuating rod operatively connected at one end thereof to the door for movement there-  
5 with, the other end of said rod being operatively connected to said bell crank.  
7. A step construction as claimed in claim 6, in which the end of said rod is opera-  
tively connected to said bell crank by means of a lost motion connection. 10  
8. A step construction substantially as hereinbefore described with reference to the accompanying drawings.

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